REMARKS

The Applicant thanks the Examiner for the comments in the Office Action, which has been carefully considered. It is respectfully submitted that all issues raised are traversed, being hereinafter addressed with reference to the relevant headings appearing in the Detailed Action section of the Office Action.

The Applicant has amended the claim set. The Applicant respectfully submits that the amendments to the claim set are fully supported by the originally filed specification.

Claim 1 is currently amended to require *"the sleeve member being of substantially smaller diameter than the diameter of the spherical body"*, support for this amendment is found for example by reference to Figure 1 showing sleeve 18 being of substantially smaller diameter than the diameter of spherical body 1, 2. Claims 14, 25 and 27 are similarly amended.

Claim 13 is currently amended to require *"the at least one passage containing an internal fluid held within the spherical body at least partially by the porous material"*. Support for this amendment is found by reference to, for example, paragraph [0046] discussing passages 5, 6, 7 and 8 being filled with fluid, or paragraph [0050] discussing example types of internal fluid. Paragraph [0030] discusses the porous material 9 allowing the internal fluid pressure to equilibrate with the external fluid pressure. Paragraph [0046] discusses that internal passages 5, 6, 7 and 8 are fully enclosed and are sealed from external water pressure by porous material ring 9. Similar amendments are made to claims 26 and 28.

Claim Rejections – 35 USC § 103

Claims 1-34 and 36-37 presently stand rejected under 35 USC 103(a) as being allegedly unpatentable over Mackenzie *et al.* (US 2005/0076709).

Claim 1 is currently amended to traverse the rejection. Although the applicant does not agree that all features of original claim 1 are found in Mackenzie the applicant has amended claim 1 in order to obtain expeditious issuance.

Claim 1 is currently amended to additionally require the feature of *"the sleeve member being of substantially smaller diameter than the diameter of the spherical body"*. Referring to the probe of Mackenzie, for example illustrated in Figure 3, the Examiner construes tube 36 to provide a sleeve member enclosing a shaft 33. Clearly, tube 36 of Mackenzie is not of substantially smaller diameter than the diameter of the spherical body, where the spherical body is construed by the Examiner as domed penetrating tip 30 of Mackenzie. Instead, tube 36 is nearly the same exact diameter as the diameter of the tip 30 as seen in Mackenzie's figures.

This feature is not a trivial design variant and provides significant advantages over the probe of Mackenzie. In the field of penetrometers, the geometry of the penetrating tip and the shaft play a critical role in the performance and usefulness of the device. Examples are discussed in the background in the present application such as cone, plate and T-bar type penetrometers. The domed/hemispherical shaped penetrating tip 30 disclosed in Mackenzie is a further variant.

The Examiner assumes that the domed/hemispherical shaped tip 30 of Mackenzie is similar in form and able to perform the same function as the presently claimed spherical body attached to the end of a shaft, where the shaft is enclosed by a sleeve member being of substantially small diameter than the diameter of a spherical body. This is not merely a geometrical design variation and would not be obvious to one of ordinary skill in the art.

In situ measurement of soil properties is performed to determine soil parameters, for example for purposes of geotechnical engineering design of foundation structures. In soft soils such as marine sediments this is particularly challenging and known penetrometers as at the priority date of the present application did not offer the capability to accurately interpret the necessary soil parameters. Empirical correction factors were required to be applied for correction of hydrostatic pressure and overburden pressure relative to tip resistance. The selection of an appropriate factor to interpret soil strength as a function of penetration resistance is empirically based and the range of possible values is large, therefore making selection of an appropriate factor difficult and usually requiring a large degree of conservatism in design.

In contrast, a spherical ball penetrometer, as presently claimed, is considered to be a full-flow penetrometer. This difference is illustrated in Figure 1 below as clarification. Theoretical

analysis shows that a spherical ball penetrometer has a closed-form analytical solution for the calculation of undrained shear strength as a function of measured ball penetration resistance. In the example embodiment of a spherical ball penetrometer, this provides a primary advantage of a more precise interpretation of soil load bearing capacity compared to the domed/hemispherical shaped penetrating tip 30 of Mackenzie. The domed/hemispherical shaped penetrating tip 30 disclosed in Mackenzie is subject to the same type of empirical correction factors as other known prior art penetrometers.

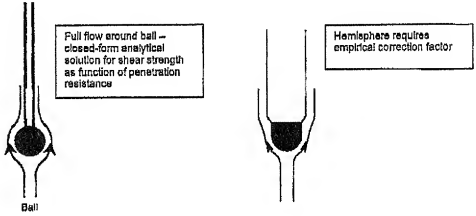


Fig.1

In order to provide a full-flow spherical geometry, or a good approximation of such, the supporting shaft and the enclosing sleeve are made to be substantially smaller in diameter than the diameter of the spherical body, as claimed in currently amended claim 1. By employing a shaft and enclosing sleeve of substantially smaller diameter than the diameter of the spherical body, the invention claimed in claim 1 advantageously provides a relatively compact penetrometer and the ability to calculate a closed-form analytical solution of undrained shear strength as a function of measured ball penetration resistance, as previously discussed. Also advantageously, the shaft and sleeve which place the spherical body at a substantial distance from the instrumentation module effectively removes the penetration tip from the area of influence where the device expands in diameter necessarily as a result of the instrumentation module 20, which is another advantage not envisaged or disclosed in the probe of Mackenzie.

In the probe disclosed in Mackenzie, directly behind the domed/hemispherical tip 30 there is provided an enclosing sleeve or tube 12 or gland nut 35, or tube 36, that is approximately at least as large in diameter as the penetrating tip 30.

A further advantageous function of a spherical body as a penetrating tip is that a spherical body allows for measurement of soil parameters in a bi-directional motion, for example as is claimed in the method claim 29. Thus, with a spherical body having a sleeve member of substantially smaller diameter than the diameter of the spherical body it is possible to measure remoulded soil strength by performing an upward ball penetrometer movement. It is also possible to perform multiple in situ compression and tension loading cycles of the soil to obtain a measure of the cyclic strength degradation characteristics of the soil. No such upward or cyclic measurement facility can be performed by the domed/hemispherical shaped penetrating tip 30 disclosed by Mackenzie.

The sleeve member as claimed in claim 1, which is adapted to isolate the shaft from external soil friction while allowing axial movement of the spherical body and the shaft, is an important improvement over known penetrometers, including the probe of Mackenzie. By isolating the shaft from the effects of soil friction on the shaft the accuracy of measurement is substantially improved. Also, in a particular example embodiment this provides the ability to link the enclosing sleeve back to a friction sleeve sensor of a typical instrumentation module. This provides the ability to detect cross-talk between the load sensor and the friction sensor, i.e. if the shaft starts to bend under extreme loading conditions or hitting an obstruction the shaft will come into contact with the enclosing sleeve and abnormal friction measurements will be sensed. Such a sleeve member is not suggested or disclosed in Mackenzie.

Claim 1 has been currently amended to more clearly clarify the distinction with the probe of Mackenzie.

A similar amendment has been made to independent claims 25 and 27.

Referring to currently amended independent claim 13, although the applicant does not concede that all features of original claim 13 are disclosed or suggested in Mackenzie, the applicant has amended claim 13 to more clearly distinguish Mackenzie. Claim 13 is

currently amended to require the feature of *"the at least one passage containing an internal fluid held within the spherical body at least partially by the porous material"*.

The Examiner asserts that Mackenzie discloses a porous material being the radial opening in the surface of the spherical body 20 illustrated in Figure 1 of Mackenzie and discussed at page 2, paragraph [0034]. This passage only discloses that a water sensor or water pressure sensor is able to be used with the sensor unit when the probe is intended for soil testing. Applicant respectfully submits that this does not disclose a porous material. To further clarify this distinction claim 13 is amended to refer to an internal fluid held within the spherical body at least partially by the porous material.

The radial opening in the surface of the spherical body 20 of Mackenzie clearly could not be considered to be a porous material that holds an internal fluid within the penetrating tip 30 of Mackenzie. Furthermore, Mackenzie does not suggest or disclose the penetrating tip 30 including at least one passage that contains an internal fluid as now required by currently amended 13.

The arrangement of Mackenzie would be expected to become quickly plugged with soil, particularly with fine grained sediments, thereby blocking any possibility of fluid communication to a water pressure sensor.

A similar amendment has been made to independent claims 26 and 28 to more clearly distinguish Mackenzie.

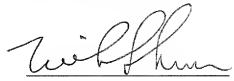
It is respectfully submitted that all currently amended claims are now clearly patentable over Mackenzie and the other cited documents. Accordingly, all dependent claims 2-12, 14-24, and 29-38 likewise disclose patentable subject matter.

Claim 35 stands rejected under 35 USC 103(a) as being allegedly unpatentable over Mackenzie in view of Bratton (US 6,644,423). In view of the amendment to claim 27, from which claim 35 depends, it is submitted that claim 35 now clearly discloses patentable subject matter over Mackenzie in view of Bratton.

CONCLUSION

In view of the foregoing, it is respectfully submitted that the present application is in condition for allowance. Accordingly, the Applicant requests a Notice of Allowance of all the claims presently under examination.

Respectfully submitted,



Registration # 43,082
Michael T. Sanderson
King & Schickli, PLLC
247 North Broadway
Lexington, Kentucky 40507-1058
info@iplaw1.net
(859) 252-0889
(859) 252-0779